
HUSKY 3CCR

Triple Communications & Charging Rack

System Developer's Guide

© Copyright 1999 WPI HUSKY TECHNOLOGY LTD
All Rights Reserved.

The information contained in this document is copyright and may not be reproduced, stored in a retrieval system in any form or by any means, electronic, mechanical, photocopying or otherwise without prior permission from the copyright holder, WPI HUSKY TECHNOLOGY LTD.

Whilst every precaution has been taken in the preparation of this document, the publisher assumes no responsibility for errors and omissions neither is any liability assumed for damage resulting from the use of the information contained within this document.

Whilst every care has been taken to ensure that the specifications in this manual are correct, WPI HUSKY TECHNOLOGY LTD accept no responsibility for inaccuracies which may occur and reserve the right to alter specifications without prior notice.

Husky) are
FS/2) trademarks
FS3) of
3CCR (Triple Communications) WPI HUSKY TECHNOLOGY LTD
& Charging Rack))

MS-DOS is a trademark of Microsoft Corp.

IBM PC and **IBM PC AT** are trademarks of IBM Corporation.

Any other trademarks used in this guide are acknowledged.

Part Number P-2249-1000-01
Printed in England

Designed and written by:
Ed Phipps at Automatic Manuals, Bognor Regis, England.

HUSKY document DMA3050-080-01

Contents

1. Introduction	1
1.1 The 3CCR	1
1.2 Using this guide	2
1.2.1 Structure	2
1.2.2 Suggested reading approach	3
1.2.3 Conventions	3
1.2.4 Special terms	4
1.3 The other guides	5
2. Installing	7
2.1 Introduction	8
2.2 Unpacking and preparation	8
2.3 Choosing a site	9
2.4 Connections	9
2.5 EMC and FCC legislation	12
2.6 Checking operation	12
2.7 Extending the installation	14
2.8 Vehicle mounting	15
3. Operating Instructions	17
3.1 Introduction	17
3.2 Starting up	18
3.3 Connecting a Handheld unit	18
3.4 Charging	19
3.5 Communications	19
3.6 Using HCOM, the HUSKY file transfer utility	20
3.7 Disconnecting a handheld unit	21
3.8 Shutting down	21
3.9 Routine maintenance	21
3.10 Problems	22
4. Programming	25
4.1 Introduction	25

4.2	Important notes	25
4.3	Background	26
4.3.1	The communications channel	26
4.3.2	Communications speeds	28
4.4	Programming notes	29
4.4.1	General principles	29
4.4.2	Enabling charging	29
4.4.3	Detecting the 3CCR	30
4.4.4	Selecting 3CCR communications	31
4.4.5	Receiving data	31
4.4.6	Sending data	32
4.4.7	The communications protocol	32
4.4.8	Low level error handling	37
4.4.9	Using peripherals while on the 3CCR	37
4.4.10	Removal from the 3CCR	38
4.4.11	Using a local printer	39
5.	Compatibility	41
5.1	Differences between the 3CCR & the FS CCR	41
5.2	3CCR and HUSKY MP2500	42
6.	Appendices	43
Appendix A:	General arrangement & connections	43
A.1	Upstream/host connector, 9-way D-type, male	44
A.2	Downstream connector, 9-way D-type, female	45
A.3	Power jack socket	46
A.4	Power input circuit	47
A.5	Spring contacts	48
A.6	Example cables	49
Appendix B:	Specification	52
B.1	Physical	52
B.2	Communications	53
B.3	Environment	53
B.4	Options	54

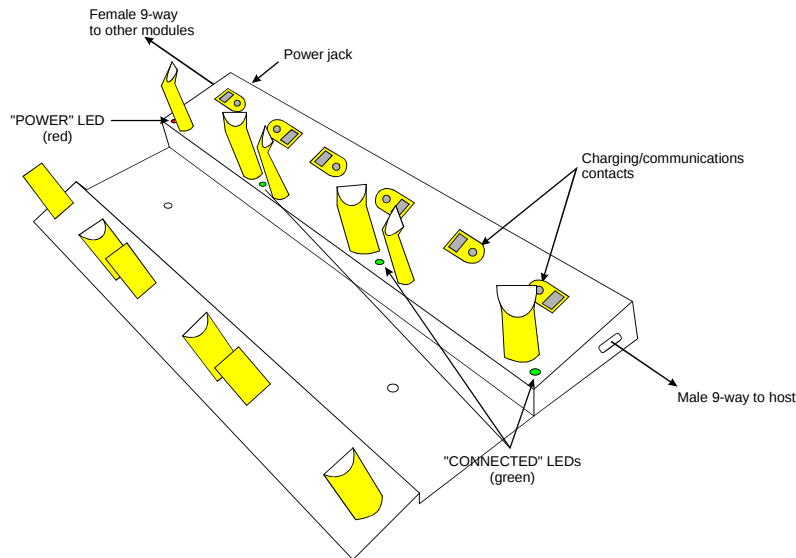
1. Introduction

Throughout this publication, the phrase **3CCR** means the **Husky Triple Communications & Charging Rack**. The phrase **handheld unit** refers to **HUSKY** handheld computers that can be used with the **3CCR**, such as the **HUSKY FS/2** and **FS3**.

Note: Please refer to the sections on AC Adaptor Precautions and Electromagnetic Compatibility near the end of this guide for important safety and statutory information.

1.1 The 3CCR

The **3CCR** provides a communications path and charging facility for suitably equipped **HUSKY** handheld computers such as the **HUSKY FS3**. To connect a **handheld unit**, you simply place it onto the **3CCR** and its spring contacts engage to connect power, turning on the handheld unit and the handheld begins charging automatically.



If the handheld unit is running a suitable application, it can detect that connection has been made, and communicate via the same contacts with a desktop computer or modem connected to the **3CCR** via a standard 9-way D type connector. Communications can be at up to 38,400 Baud, and can support individual and broadcast modes.

The **3CCR** can be easily extended by adding further units. It can be desk or shelf-mounted for user convenience and carries a number of indicator LEDs for simple monitoring.

1.2 Using this guide

1.2.1 Structure

This guide is divided into the following chapters:

- | | |
|--------------------------|--|
| 1: Introduction | A brief introduction to the 3CCR and this guide, which you should read first. |
| 2: Setting up | How to unpack and set up the 3CCR , and extend it (by adding further units). |
| 3: Operator instructions | How to use and maintain the 3CCR . |
| 4: Programming | How to write applications to use the 3CCR for communications. You should read this information in conjunction with the System Developer's Guides for the HUSKY computers that will be used with it, such as the <i>HUSKY FS3 System Developer's Guides</i> . You may also need to refer to a general MS-DOS Programmer's Manual if you are not already familiar with programming under MS-DOS. |
| 5: Compatibility | Notes on the 3CCR's compatibility with the HUSKY FS CCR and the HUSKY MP2500 handheld. |
| 6: Appendices | Summary technical data, for ease of reference. |

AC Adaptor Precautions Precautions that you must read and under-stand before using the **3CCR AC Adaptor** to power the **3CCR**.

Electromagnetic
Compatibility (EMC) Statutory information and statements on electromagnetic compatibility of the **3CCR**.

There is also a detailed index at the end of the guide.

1.2.2 Suggested reading approach

Whatever your interests, you should start by reading the rest of this chapter (Introduction). Then:

- If you are installing the **3CCR**, read Chapter 2.
- If you are going to operate the **3CCR**, read Chapter 3.
- If you are writing applications to use the **3CCR**, read Chapter 4.

1.2.3 Conventions

Throughout this guides, a few simple conventions are used to help clarify descriptions. These are mainly used to indicate text to type, as follows.

DIR this is text which should be typed exactly as shown. If you prefer, you may type it as the equivalent small letters (d i r).

filename this is a description of text to type, rather than the actual characters. In this case, you should type the name of a file (for example, PROGRAM1).

E this is a name or symbol representing the key
I that you should press or hold down. In most cases, the name or symbol is the same as appears on the key.

[,A] this is an optional part of the text ie text which may be omitted or typed, depending on what you want to do.

Enter new date text as it appears on the screen.

These conventions are often used in combination. For example:

DIR [filename] E Means type **D I R** and then a space, then either press the **E** key, or type the name of a file and press **E** .

1.2.4 Special terms

Within this guide, a few special terms are used for conciseness, as follows:

host The computer system which is communicating with the handheld units on the **3CCR**, such as a desktop PC, minicomputer or mainframe. This will require a custom application for this purpose. The host may be connected directly or via a modem.

the **FS/2** A **HUSKY FS/2** handheld computer.

the **FS3** A **HUSKY FS3** handheld computer.

the **MP2500** A **HUSKY MP2500** handheld computer.

the **handheld** A **HUSKY** handheld computer, such as the **HUSKY FS3**.

3CCR unit
(or **Triple Rack**) A **3CCR** installation can consist of a number of **3CCR** units, each of which supports up to three handhelds at a time. An installation normally shares a single host connection.

Rack
communications General term for communications between a **HUSKY** handheld and a host computer via the **HUSKY** Rack interface.

1.3 The other guides

You may also need to refer to other standard documentation, including:

<i>HUSKY 3CCR User & Installation Booklet</i>	This booklet describes only how to install and operate the 3CCR . Note that the same information is reproduced in this manual.
---	---

<i>FS/2 User Leaflet</i> <i>FS3 User Leaflet</i>	Tells an operator how to use and look after the handheld unit.
---	--

<i>HUSKY FS/2 and FS3 System Developer's Guides</i>	Technical information, for the personnel who maintain and develop software for the handheld unit.
---	---

These guides:

- Introduce you to the handheld unit.
- Explain how to set up, maintain, fault-fix and expand the handheld unit, including details of commands which are not provided by a desktop MS-DOS computer.
- Provide additional technical information that you will need to write or adapt programs for the handheld unit, concentrating on details that are different to a desktop MS-DOS computer.

<i>The HUSKY File Transfer Utility Guide</i>	How to use the HUSKY HCOM utility to transfer files between a handheld unit and a PC compatible. Or you can refer to the <i>Readme</i> file (DOS version of HCOM) or the <i>Help</i> file (Windows version of HCOM) which are supplied with HCOM.
--	--

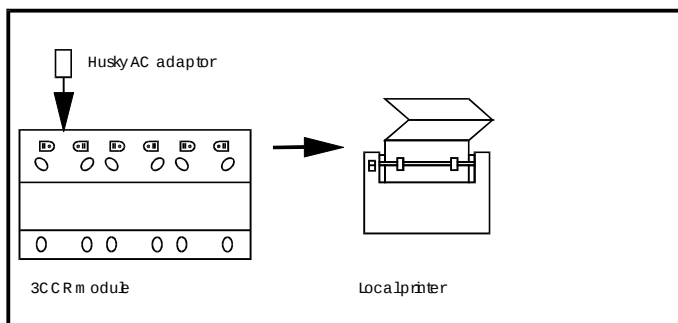
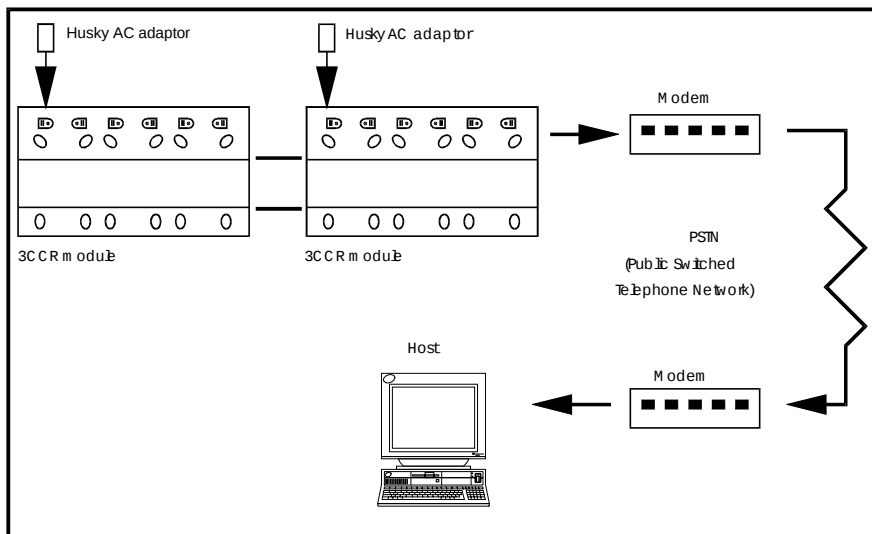
IMPORTANT: You should supply operators with the appropriate User Leaflet for the type of **Husky handheld** being used - this leaflet contains important Safety and Legislative information.

You should also supply operators with information on using the application which you install on the handheld unit. You may also want to provide them

with additional information (such as how to change batteries), if they have to cope with such situations on their own.

2. Installing

Some typical **Husky 3CCR** installations:



2.1 Introduction

Read this chapter before installing one or more **3CCR** units. It tells you how to:

- Prepare for the installation
- Choose a site
- Mount the **3CCR**
- Connect up
- Check operation
- Extend an installation

2.2 Unpacking and preparation

Unpack and check the **3CCR** units for any obvious signs of damage.

Power supplies and cables are all optional and available separately.

Power:

To power the **3CCR**, you must supply a nominal 9V 3A DC to each **3CCR** unit, using HUSKY-approved power supplies, such as the optional **3CCR AC Adaptor**. The power supplies must supply the following:

Nominal current	3.0A per 3CCR unit
Minimum current	2.6A per 3CCR unit
Nominal voltage	9.0V
Minimum voltage	8.0V (at the 3CCR input)
Maximum (continuous)	10.0V

The power connector should be wired as described in Appendix A.3. For information on installing power supplies, see section 2.4.

Cables:

For connection directly to a host or local printer, you will need a "crossed" (null modem) cable. For connection via a modem, you will need a

"straight" (1-1, 2-2, etc) cable. If you are interconnecting **3CCR** units by using a cable, you will need a "straight" 9-way to 9-way cable.

Suitable cables are available as options, or see Appendix A.1 and A.2 for connector pinouts and Appendix A.6 for cable wiring diagrams.

2.3 Choosing a site

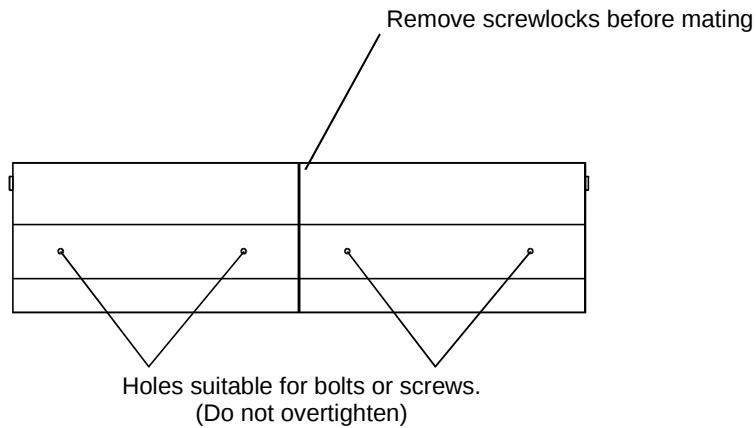
When choosing a site for the **3CCR** installation, note the following:

- The conditions at the site must comply with the environmental details listed in Appendix B.3.
- The **3CCR** is designed to be mounted on a horizontal surface (e.g. desk, bench, or shelf.) Note that the **3CCR** is not designed for mounting *directly* to a wall or vertical surface, although a suitably angled shelf could be used instead.
- For installations of more than one **3CCR** unit, refer to **section 2.4**.
- The location should have easy access (for mounting and de-mounting the handheld units), but be unlikely to be knocked in normal use.
- The location should have the appropriate number of AC outlets within easy reach (such as one per **3CCR** AC adaptor).
- The right-hand end of the **3CCR** connects to the host's communications connector or to a modem link.
- If the installation is likely to be expanded, remember to choose a location which has sufficient space, to minimise the additional effort required.

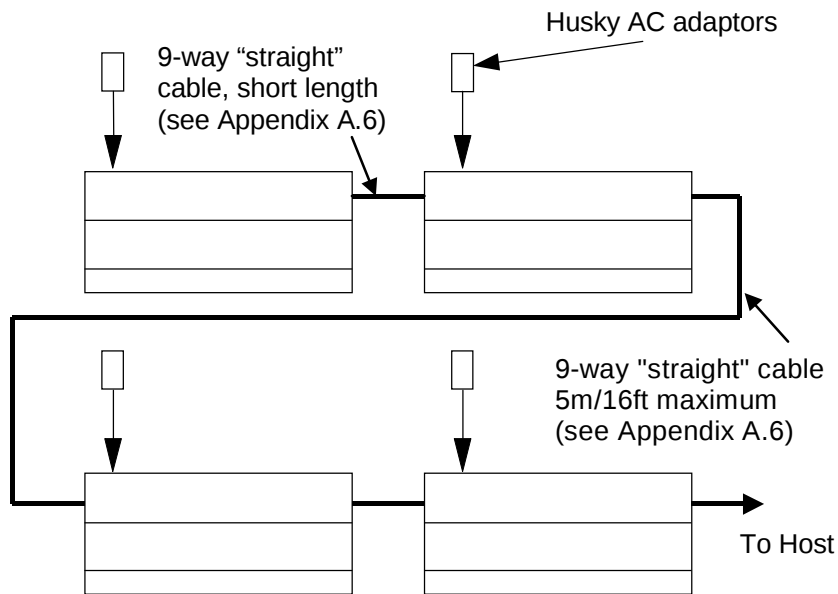
2.4 Connections

- Installations of more than one **3CCR** unit require:
 - *either* connecting with cables (see Appendix A.6)
 - *or* unscrew the screw locks on the D-type connectors (on the sides of each **3CCR** unit) and push the **3CCR** units directly together. Remove the screw locks with a spanner. Line up and push together the mating male and female connectors, so that they mate fully. Note the **3CCR** base plate has two holes for securing each **3CCR** to

the desk or shelf, to prevent accidental movement and poor interconnection. It is **very important** that the **3CCR** units are secured in this way.



- If you are interconnecting several groups of **3CCR** units, you will need a "straight" 9-way to 9-way cable. The recommended maximum cable length is 5m (16ft). See Appendix A.1 and A.2 for D type pinouts and Appendix A.6 for cable details.
- Check that each **3CCR** unit is properly connected to the next via their D-type connectors or cable.
- Connect DC power as follows:
 - Using the **Husky AC adaptors**, connect an adaptor to the power socket at the top of each **3CCR** unit and plug each adaptor into a convenient AC outlet:



Note: Each **3CCR** unit must have its own AC adaptor connected.

- Connect the right-hand end of the **3CCR** to the host connector, local printer or modem:
 - To connect direct to the host, use a "crossed" (null modem) cable.
 - To connect via a modem, use a "straight" (1-1, 2-2, etc) cable.
 - To connect to a local serial printer, use a "crossed" (null modem) cable.

See Appendix A.1 and A.2 for D type pinouts and Appendix A.6 for cable details.

Caution: Refer to section 2.6 for information on complying with EMC legislation.

If you are using a modem link, install it as per the modem supplier's instructions.

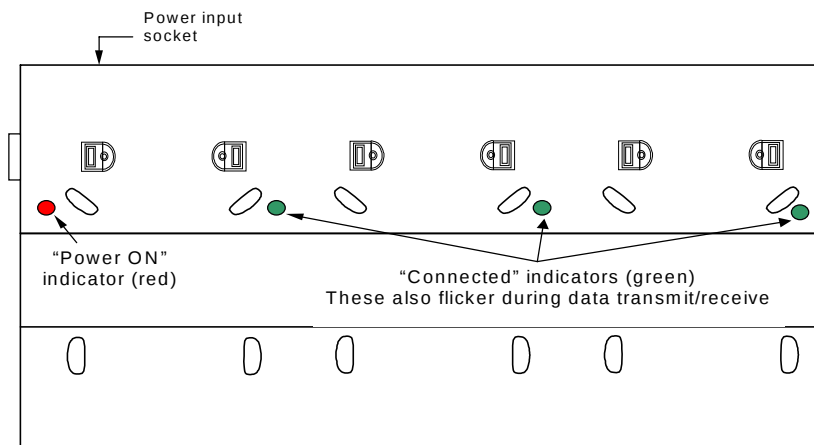
2.5 EMC and FCC legislation

To ensure compliance with EMC legislation:

- Changes or modifications could void the user's authority to operate the equipment.
- Use only the **3CCR AC Adaptors** to power the **3CCR**.
- All communications cables must be shielded, with the shield grounded. Use approved cables.
- The maximum system configuration may be limited by local EMC regulations. WPI HUSKY TECHNOLOGY LTD has EMC certification for systems comprising up to 4 interconnected **3CCR** units.
- The **3CCR** must only be used with approved peripherals and approved power supplies.

Also see the 'Electromagnetic Compatibility' section, near the end of the guide.

2.6 Checking operation



- Turn on each AC adaptor and check that the red POWER LED lights on the appropriate **3CCR** unit:

IF IT DOES NOT, try another adaptor and AC outlet. If this does not light the LED, the **3CCR** unit is probably faulty.

- Mount a handheld running HCOM on each position in turn and check that the appropriate CONNECTED LED lights.

IF IT DOES NOT, clean the contacts on the **3CCR** and the handhelds and check that the **3CCR**'s spring contacts are not sticking. Check that the handhelds are fitted with the **Rack Interface** option. Try another handheld. If none of this helps, the **3CCR** may be faulty.

To see if an **FS/2** unit is fitted with the **Rack Interface** option, check its product code, which is in the form H-abc-xnyz. As a general rule, if the "n" character is a number (not a letter), the interface option is fitted. However, if the "x" character is an N (denoting a custom version of FS/2), then you cannot determine whether a Rack Interface is fitted – please contact your system supplier or HUSKY TECHNOLOGY LTD.

To see if an **FS3** is fitted with the **Rack Interface** option, check that the configuration on its rear label includes **/RACK/**.

- Load the communications application on a handheld unit and mount it in the most right-hand location (nearest the host connection). Run the application on the host and handheld unit and check that the CONNECTED LED flickers, and the application behaves correctly. (If the application is not available yet, a simple test can be carried out by using HCOM, the **HUSKY** file transfer utility. Refer to section 3.6.) Note that depending on the amount of data and the ambient light levels, the visibility of the flickering (or twinkling) may be limited.

IF COMMUNICATIONS DO NOT OPERATE, check the cable, and the applications running on the host and handheld unit. Make sure that the cable is correct and plugged into the right-hand end of the **3CCR**. Try another handheld unit. Check that the handheld unit is fitted with the **Rack Interface** option (as described above)! Swap the right-hand **3CCR** unit with another and try again.

- Finally, mount the handheld unit in the most left-hand location (furthest from the host connection), run the application and check that the LEDs light again.

IF COMMUNICATIONS DO NOT OPERATE, the **3CCR** units may not be daisy-chaining correctly. Move the handheld one position to the right and try again, repeating until communications operates properly; the daisy chaining problem lies in this unit or the one to its left. To determine which is at fault, swap **3CCR** units.

- If you experience occasional or intermittent communications errors, check carefully that your cable connections conform to those shown in Appendix A.6. In particular, if you are running at speeds greater than 19,200 Baud it is important that the CTS and RTS pins are not connected (or are permanently driven into the active state). It may not be sufficient to merely disable the CTS/RTS handshaking at the software level. The **HUSKY** HCOM file transfer utility is designed to operate without CTS/RTS connected.

More information on troubleshooting is included in section 3.10.

The **3CCR** is now ready for use.

2.7 Extending the installation

To extend a **3CCR** installation, you need to purchase the appropriate number of **3CCR** units, AC adaptors, and interconnecting cables, and then fit them as described earlier in this chapter.

Caution: Disconnect the AC adaptors before plugging or unplugging 3CCR units.

Each **3CCR** delays signals by another 5 microseconds, so in a system of more than about four **3CCR** units the maximum Baud rate may be reduced to 19,200. The maximum recommended size for a single **3CCR** installation is four **3CCR** units.

Caution: The maximum system configuration may be limited by local EMC regulations. WPI HUSKY TECHNOLOGY LTD has EMC certification for systems comprising up to four interconnected 3CCR units. Consult your system supplier for advice. Refer to section 2.5 for information on complying with EMC legislation.

To make a large installation more manageable, you can interconnect groups of **3CCR** units by using a cable as described in section 2.4.

2.8 Vehicle mounting

Caution: The 3CCR is not intended for vehicle mounting. Safety issues may apply.

3. Operating Instructions

Note: To use the **3CCR** for communications, a handheld unit must be fitted with the **Rack Interface** option and be running an application written for this purpose.

Note: The **3CCR** can be used for communications even if the handheld units are fitted with non-rechargeable (alkaline) batteries. **However, it is essential that charging is disabled as described in Chapter 8 of the appropriate *System Developer's Guide*.**

Note: If non-rechargeable batteries are fitted, we recommend that you remove the handheld unit from the **3CCR** when the communications session is complete. Do NOT store the handheld unit on the **3CCR** for prolonged periods.

Important: Operators of the handheld unit and **3CCR** should be supplied with the *User Leaflet* for that handheld unit, which contains important safety and legislative information.

3.1 Introduction

Read this chapter before using or maintaining the **3CCR** installation. It tells you how to:

- Start up the **3CCR**
- Connect the handheld units
- Monitor charging
- Monitor communications
- Disconnect the handheld units
- Shut down the **3CCR**
- Perform routine maintenance
- Handle problems

To control or check the handheld units, you may need to know how to use the HOT key: with the developer's (default) keyboard selected, hold down the PAW (W) key and press **H** to use the HOT key. For full details, see the handheld unit's *System Developer's Guide* (eg the *HUSKY FS/2*, *FS3* and *MP2500 System Developer's Guides*).

3.2 Starting up

The **3CCR** will normally be left powered on continuously, but if you need to power it on:

- Check that the right-hand D type is connected to the host communications cable.
- Turn on each of the AC adaptors and check that the POWER LED lights on each **3CCR**. (If not, see section 3.10.)
- The **3CCR** is now ready for use.

3.3 Connecting a Handheld unit

- Place the handheld unit on the **3CCR** and let it slide down between the support pillars.
- Press the handheld unit firmly onto the **3CCR** against the contacts until the magnets engage.
- Check that the CONNECTED LED lights. If not, try sliding the handheld unit up and down a couple of times to seat the contacts.
- The handheld unit's screen should display a status message such as **Charging in progress** (depending on the application).
- To download data from the host or upload information to it, turn on the handheld unit and follow your application's user instructions.

(Depending on the application, you may not need to turn on the handheld unit or select any options to use the **3CCR**.)

3.4 Charging

Caution: Do not attempt to recharge a handheld unit on the **3CCR** unless you are sure that it contains rechargeable batteries (NOT alkaline batteries). The batteries must be correctly oriented, inserted positive end first. If alkalines are fitted, disable charging (see Chapter 8 of the handheld unit's *System Developer's Guide*).

While on the **3CCR**, a handheld unit will normally recharge its batteries automatically within a few hours. The time required depends on the battery state and type of handheld unit, but for an **Handheld** with fully discharged NiCd batteries it will typically be 6 to 8 hours in Advanced Power Management (APM) mode and up to 15 hours in Standard Power Management (SPM) mode. (Higher capacity NiMH batteries will require longer – refer to the instructions provided with the **Handheld**.) All you need to do is:

- Check that the CONNECTED LED stays lit. IF IT DOES NOT, the contact may be poor or may have been disturbed, or the AC adaptor may be switched off (check the POWER LED). Try re-seating the handheld unit on the **3CCR**.
- Remove the handheld unit from the **3CCR** once it has charged and carried out any communications required. Typically, you will simply leave it for several hours, but you can also turn the handheld unit on and use either the application or the HOT key to check the power level (if Advanced Power Management (APM) is enabled). (See section 3.7 for more details.)

The application may be written to monitor its power level and communications requirements and tell you when you can remove it from the **3CCR**, eg by beeping or displaying a message.

3.5 Communications

If communications are being used, they should be handled automatically by the applications running on the handheld unit and host. Data transmissions make the appropriate CONNECTED LED flicker. The amount of flicker is dependent on the baud rate, i.e. at lower baud rates the flicker is more pronounced.

- Check that these LEDs flicker as expected, as a simple check on operation.
- The application may also display progress or error messages, so you can monitor the situation by checking the handheld unit's display: see the application notes for details.
- Finally, if an application encounters a situation which requires your attention (such as loss of the host connection, or repeated timeouts), it may attract your attention by beeping repeatedly. Check the handheld unit's display for instructions on what is required.

If alkaline (non-rechargeable) batteries are fitted to the handheld unit, CHARGING MUST BE DISABLED (see section 3.4), but you can still use the **3CCR** for communications. We recommend that you remove the handheld unit from the **3CCR** when the communications session is complete. Do NOT store the handheld unit on the **3CCR** for prolonged periods.

3.6 Using HCOM, the HUSKY file transfer utility

HCOM is a versatile file transfer utility supplied by WPI HUSKY TECHNOLOGY LTD which is designed to make transferring files between a PC and a handheld unit quick and easy. The PC component is supplied on a diskette, while the handheld unit component is built into its software.

General instructions for using HCOM are included in the *HUSKY File Transfer Utility Guide*, and the *Readme* file (DOS version of HCOM), or the *Help* file (Windows version of HCOM). To connect via the **3CCR**, observe the following additional points:

- Place the handheld on the **3CCR** and wait for the CONNECTED LED to illuminate before turning on the handheld and running HCOM.
- HCOM will normally run at 38,400 Baud. When connecting via the **3CCR** at this speed, CTS and RTS must not be connected to the host. If they are, run HCOM at 19,200 Baud instead as described in the HCOM instructions.
- HCOM is resident in the handheld unit's software, so you do not need to download it from the PC as described in the HCOM instructions.

3.7 Disconnecting a handheld unit

Typically, you will wait several hours (eg overnight) so that all handheld units are fully charged and have finished communications.

- To check if communications has finished: turn on the handheld unit and the application should display a message to this effect (perhaps after selecting an option).
- To check if charging has finished: turn on the handheld unit and the application should display a message to this effect (perhaps after selecting an option). If not, use the HOT key to check the power level.

To remove a handheld unit from the **3CCR**, simply slide it back off the supports.

3.8 Shutting down

The **3CCR** will normally be left powered on continuously, but if you need to power it down, simply power down the AC adaptors. (You do not need to disconnect any handheld units or the host link.)

3.9 Routine maintenance

The **3CCR** does not require significant regular maintenance, but to minimise problems you should do the following about once a week:

- Clean all the sprung contacts with a clean cloth and a mild alcohol-based cleaner, and check the springing.
- Clean the Rack contacts on the back of each handheld unit with a clean cloth and a mild alcohol-based cleaner.
- Check the fault log. If any **3CCR** unit or handheld unit has persistent problems, check it for faults.

In addition, to ensure that the handheld units' NiCd rechargeable batteries retain their full capacity, we recommend that you put them through a full discharge cycle periodically - perhaps once a week, depending on usage. (Battery discharge cycles are not generally necessary if you are using NiMH batteries.) If your application is written to the guidelines given in

Chapter 4, it will provide this facility, so refer to the application's user instructions.

3.10 Problems

This section summarises how to handle common types of problems which you may encounter while using the **3CCR**:

Note: Log any errors and problems that you encounter, with the date, time, **3CCR** serial number, handheld position(s) and handheld serial number(s) involved, to help with fault diagnosis.

If there is a power cut or brownout while using the **3CCR**, when power returns charging will continue correctly and the individual handheld units should resume communications, providing the applications have been written according to the guidelines in Chapter 4.

If a **3CCR** does not charge the handhelds and the POWER LED *does not* light, check the AC adaptor and supply. If this does not help, the **3CCR** unit may be faulty.

If a **3CCR** does not charge the handhelds but the POWER LED *does* light, clean the contacts on the **3CCR** and check their springs, clean the handheld unit contacts, check that charging is enabled (eg by using the HOT key), try another handheld unit. If this does not help, the **3CCR** unit may be faulty. If the handheld unit has a peripheral connected, it may be drawing too much current for the AC adaptor: try disconnecting it or disabling it via the application (if it provides this option).

If none of the **3CCR** units charge, check the AC supply. Note that handheld units will disable charging if the ambient temperature is below approximately 5°C (41°F) or above approximately 40°C (104°F).

If a **3CCR** charges but does not allow communications: clean each pair of contacts on the **3CCR** and check their springs, clean the handheld unit contacts, try another handheld unit. If this does not help, the **3CCR** unit may be faulty.

If a handheld unit does not appear to display messages, the screen contrast may be too low. Adjust the contrast, for example by holding down either S (SHIFT) key and pressing G or H .

If none of the **3CCR** units allow communications: check the host is operating correctly, check the host cable, and try swapping the right-hand **3CCR**.

If the application warns you about frequent communications errors: clean the contacts and check their springs, check that the AC supply is stable, record whether handheld units were being added or removed when the problem occurs, check the host cable for faults, and check that each handheld unit has a different address number in its software.

If error messages are displayed on the handheld unit screens, refer to the Software Application's operating instructions.

Note that for communications between the **3CCR** and the host at speeds greater than 19,200 Baud, hardware handshaking (RTS and CTS) cannot be used. You can make sure of this in one of three ways:

- 1 The recommended method is to use a "three wire" cable (connecting Tx, Rx and Signal Ground plus screen only). This is the simplest way to ensure success. HCOM is designed to work with this type of connection.
- 2 Or, if the handshake lines are connected, the communications software in both the host and the handheld unit must fix them in the asserted (active) state throughout the communications session.
- 3 Or the handshake inputs can be link wired in the cable or its connector to a suitable signal to force them to the asserted state. In some installations it may be appropriate to use DTR for this purpose, if DTR is permanently asserted during communications. This solution has the advantage that software can more easily detect problems such as a cable becoming disconnected. The difficulty is that there are a number of connections and signal configurations that can work together, but everything has to be right to achieve high Baud rates!

For more information on communications speeds and hardware handshaking, refer to sections 2.6 and 4.3.2.

4. Programming

4.1 Introduction

This chapter consists of the following main sections:

Important notes	Important information.
Background	Describes the basic principles of using the 3CCR , from the programmer's point of view, including the recommended communications protocol functions.
Programming notes	Describes how to implement programs on the handheld unit and host to communicate via the 3CCR .

Please read all three sections.

4.2 Important notes

- The **3CCR** can be used for communications even if the handheld units are fitted with non-rechargeable (alkaline) batteries. **However, it is essential that charging is disabled as described in Chapter 8 of the Handheld unit's *System Developer's Guide*.**
- The **3CCR** should not be regarded as a totally error-free communications channel by the systems programmer. Error handling must be included in the communications protocol; see sections 4.4.7 and 4.4.8.

4.3 Background

This section describes the basic principles of **3CCR** communications. For a discussion of their use when implementing communications, see section 4.4.

4.3.1 The communications channel

Communications between the host and the handheld units is achieved by modulating the data signals onto the charging lines. Handshaking signals are transmitted by a combination of frequency shifts. Therefore, communications is only possible while a current is flowing across the **3CCR** to the handheld unit contacts. The handheld unit ensures that a sufficient (small) current flows even if charging is disabled.

Communications thus consists of the following steps:

Starting the link:

- When a handheld unit is placed on the **3CCR** a small current flows through its contacts (even if charging is disabled). The **3CCR** checks the resistance offered by the handheld unit to decide whether the contact is good enough for reliable communication, and provides DSR to the handheld unit if it is.

During this period (of about 1 second after placing on the **3CCR**), the handheld unit must not attempt to use COM1 (or must keep DTR off), to allow the BIOS to check for a good contact.

- The handheld unit's application can detect that it is on a **3CCR** by using an extended BIOS function (INT 14H, function 2EH), and switch to Rack communications by using another function (INT 14H, function 2FH). This will allow it to receive data and handshaking signals from the host.
- To send data to the host, the handheld unit must take control of the communications link, by turning DTR on, after which all the **3CCR**'s RS232 signals are available (Tx, Rx, RTS, CTS), apart from DSR which should remain ON.

Using the link:

- All signals sent by the host/modem (except DSR) pass through the **3CCR**, so that each connected handheld unit receives them simultaneously. The signals to the handheld unit from the **3CCR** operate as follows:
 - DSR is not transmitted through the **3CCR**, but the handheld unit assumes DSR is on when it detects a communications signal from the **3CCR**.
 - TxD is transmitted at the configured data rate (up to a maximum of 38,400 Baud).
 - CTS is transmitted at the configured data rate (up to a maximum of 19,200 Baud).
- All signals from handheld units to the host/modem are combined (ORed) by the **3CCR** to form a daisy-chain, so that each signal received by the host/modem will only be off if all handheld units are asserting it off. If no handheld units are present, all signals are off. Note that to avoid data corruption, only one handheld unit at a time must transmit data; this is the responsibility of the communications protocol used (see section 4.4.7).
 - In order to transmit RxD and/or RTS, DTR from the **handheld must be ON**. The handheld unit can only transmit these signals while DTR is ON.
 - RxD is transmitted at up to 38,400 Baud.
 - RTS is transmitted at up to 19,200 Baud.

Finishing the link:

There are two ways to end the link between a handheld unit and the **3CCR**:

- By an application turning DTR off. The handheld unit can then be removed, or the link can be restarted.
- By an operator removing the handheld unit from the **3CCR**. The communications protocol provided by the application must detect any interruption to communications in progress at the time. The host will detect disconnection via an ACK timeout. The handheld unit's application will detect disconnection as loss of DSR.

The first method is preferable since it greatly reduces the chance of corrupting communications.

Important - error handling:

There is no error detection or correction built into the **3CCR**; this is the responsibility of the applications running on the host and individual handheld units (see section 4.4.7).

4.3.2 Communications speeds

The **3CCR** supports communications speeds up to a maximum of 38,400 Baud. However, the following limitations apply to RTS/CTS handshaking.

- Communications with full RTS/CTS handshaking is supported to a maximum of 19,200 Baud only, whether half duplex or full duplex.
- Communications at speeds greater than 19,200 Baud up to a maximum of 38,400 Baud is only supported WITHOUT RTS/CTS handshaking. You must ensure that:
 - i) The handheld unit RTS signal (on COM1) is set permanently OFF (inactive) during communications.
 - ii) Either RTS and CTS are NOT connected in the Host to **3CCR** cable.

Or, if a "crossed" cable is used (see Appendix A.6), ensure that the Host sets the RTS signal to OFF (inactive), to produce a "line low" state on the cable.

For more information on communications speeds and hardware handshaking, see sections 2.6 and 4.3.2.

4.4 Programming notes

4.4.1 General principles

To communicate via the **3CCR**, an application should be running on the handheld unit and the handheld unit must be turned on when it's being placed on the **3CCR** or once it is on the **3CCR**. This application must detect it is on the **3CCR**, switch from using the main communications port (Port 1) to communications via the charging contacts, and then implement a protocol to allow shared use of the link with the host and handle communications errors and disconnection. It should also keep the operator informed of progress or problems, by audible alarms and/or displayed messages.

Important: If the host connection is via a modem, note that the **3CCR** does not support **RI** (or **DCD**).

Note that the **3CCR** is connected via the handheld unit's COM1 only.

For more details of any of the handheld unit's interrupts mentioned in this guide, see the handheld unit's *System Developer's Guide*.

4.4.2 Enabling charging

To use the **3CCR** for charging, you must check that the handheld unit is fitted with suitable rechargeable batteries, then enable charging by using INT 15H, function 7FH.

Caution: Do not attempt to recharge a handheld unit on the 3CCR unless you are sure that it contains rechargeable batteries (NOT alkaline batteries).

To provide accurate monitoring of charging, use Advanced Power Monitoring (APM), selected by using interrupt INT 15H, function 89H. Select charging authorisation 4, by using INT 15H, function 65H. You can disable charging when the handheld unit is removed from the **3CCR**, as described in section 4.4.10.

Note: The handheld unit will disable charging if the temperature drops below 5°C (41°F) or rises above 40°C (104°F).

To ensure that NiCd rechargeable batteries retain their full capacity, they should be put through a full discharge cycle periodically (perhaps once a week, depending on usage). This facility is provided via a handheld unit BIOS function, which you should access from your application. (Routine discharge of NiMH batteries is not generally necessary.)

Caution: While charging on the 3CCR, the Handheld unit's ability to power peripherals is reduced or removed altogether (depending on the power management mode), so use of peripherals while on the 3CCR must be carefully controlled. For details, see section 4.4.9.

4.4.3 Detecting the 3CCR

To use the **3CCR**, the operator must select the application's "Download data" or "Host communications" option, either before or after placing the handheld unit on the **3CCR**. The application should then display a message, for example:

**Checking link.
DO NOT TURN OFF YET!**

The application can then check whether it is on the **3CCR** by using INT 14H function 2EH.

Note: To allow the **3CCR** to detect its presence, the handheld unit must not initiate any communications within 1 second of being placed on the **3CCR** ie it must set DTR to OFF.

If it is on the **3CCR**, the application can proceed with the next stage, described in the next section.

If the application does not detect the **3CCR**, it should ensure that normal communications is selected (INT 14H function 2FH), then check COM1 DSR:

- If DSR is on, the handheld unit is connected directly to the host. If so, the remainder of this chapter does not apply!
- If DSR is off, the handheld unit might not be mounted properly on the **3CCR**, or the unit might be faulty. Prompt the operator to check and press `E`, then check for presence of the **3CCR** (Rack) again.

4.4.4 Selecting 3CCR communications

Now you have established that the handheld unit is on the **3CCR**:

- Select Rack communications by using INT 14H function 2FH.
- Ensure that COM1 DTR is off (INT 14H function 2CH) and wait for at least 1 second (to allow the **3CCR** to detect the handheld unit).
- Check DSR to see if the connection (to the **3CCR**) is good:
 - If DSR is on, proceed to the next section, with DTR still off.
 - If DSR is off, display an error message such as **Please check connection with 3CCR. Continue (Y/N)**. If the user replies Y, check DSR again. If the user replies N, disable Rack communications (INT 14H function 2FH), leave DTR off and exit communications.

Note: If the application does not turn DTR off and wait for 1 second, the **3CCR** will not detect the handheld unit. The handheld unit will be able to receive data from the host, but will not be able to send data. The CONNECTED LED will also remain off.

4.4.5 Receiving data

You have now established that the handheld unit is connected to the **3CCR** with a good contact. At this stage, any data or handshaking from the host will be received by the handheld unit (and any other handheld units on the **3CCR**).

To receive data, use the appropriate BIOS functions, direct hardware I/O addressing or standard COM1 interrupts (IRQ4).

Typically, data is transmitted in blocks, which include address numbers to direct the data block to the appropriate handheld unit, error-detection, and link control blocks. See section 4.4.7 for details of the protocol.

Note that if connected via a modem, the **3CCR** does **not** support Ring Indicator (RI) or Data Carrier Detect (DCD).

4.4.6 Sending data

To send data to the host, a handheld unit must first turn DTR on.

To share the single line between the multiple handheld units, the host will normally poll them by their address number to invite them to begin transmitting. (Alternatively, each handheld unit could have a separate time slot within which it can transmit, but this is rather less flexible.)

4.4.7 The communications protocol

The **3CCR** does not include error-handling or collision-avoidance mechanisms; these are the responsibility of the applications running on the host and individual handheld units, and are defined as a communications protocol. The details of the communications protocol are left to the applications writer, however, the following suggestions may help:

Collision avoidance:

Since all data transmitted by handheld units is ORed, only one handheld unit at a time must transmit data to the host/modem. To do this, a handheld unit asserts DTR ON (eg by using INT 14H, function 2CH). To make sure that only one handheld unit at a time transmits, either the host application must poll each (possible) handheld unit in turn, granting it permission to transmit, or each handheld unit must be assigned a separate fixed time slot. Polling is preferred as it is more reliable and resilient.

Polling requires that each handheld unit has a unique "address" that the host can use, stored in the unit's application. The host loops through its list of handheld units, polling each one in turn until it gets a positive response. It then exchanges messages with that handheld unit, terminates the link with it, and removes it from its list and continues polling the remaining

units. This loop might iterate until a fixed time, until all handheld units have been serviced, or until the operator intervenes.

Note that the individual **3CCR** units and each handheld position are all equivalent; **they** do not themselves have "addresses", the handheld units do.

Broadcast messages:

As all handheld units on the **3CCR** can receive any of the data received from the host, "broadcast messages" which are intended for all handheld units can easily be sent by using a unique block type. To direct a message to a particular handheld unit, label it with that unit's "address".

Error handling:

Communications errors may be introduced by many different factors, including line noise, adding handheld units to or removing handheld units from the **3CCR** during a communications session, knocking the **3CCR** during a communications session, and faulty equipment. To minimise problems, the applications running on the host and handheld units **must** implement a robust (fault-tolerant) protocol.

Summary:

The communications protocol must therefore include:

- Identification of each handheld unit by a unique number, used by the host to address messages to that unit and invite it to take control of the link, when appropriate (polling).
- Control blocks, to select the correct handheld unit and manage transitions between the various stages such as host transmit, handheld unit transmit, and link terminate.
- Data blocking, which parcels information into manageable portions so that error-handling does not become unwieldy.
- Checksums on each block, so that the receiver can detect data errors.
- Positive (ACK) and negative acknowledgements (NACK), so that the receiver can request re-transmission of a corrupted block (by sending a

NACK), while the transmitter can detect that a block has not been received correctly (no ACK received).

- Re-transmission of blocks when appropriate (eg NACK). The transmitter must only re-transmit a limited number of times before terminating the link (with suitable alarms/log messages), so a repeated communications error won't lock up the system.
- Time-outs, so a fatal communications error won't lock up the system.
- DSR polling by the handheld unit's application. If DSR is lost, the connection to the **3CCR** has been lost and data may be invalid. The handheld unit should ignore the current block and start the connection sequence again, or the host should time out and attempt to re-establish the link.

EXAMPLE PROTOCOL: polling with a fixed list:

- The host compiles a list of address numbers for the handheld units with which to communicate, then sets a counter to the start of the list.
- The host polls the next handheld unit in its list.
- The host waits for a short period (eg 5 seconds) for a positive acknowledgement (ACK) from that handheld.
- If it receives an ACK, the host exchanges messages with that handheld unit and then removes the address number from its list.
- If the list is not empty, the host sets the counter to the next handheld unit in the list and carries on from the second step.

EXAMPLE PROTOCOL: exchange with a single Handheld unit:

- The host sends a POLL block with the address number (eg 17), then waits for a few seconds for a reply.
- Handheld unit 17 detects a poll for its number and raises DTR to use the link. It then sends a positive acknowledge block (ACK) within the time limit, or a negative acknowledge block (NACK) if it recognises its address number but the block is otherwise corrupted (the host will re-transmit the POLL block; see below).

Note: If the block checksum includes the address and the handheld unit detects a checksum error, then it will discard the whole block

including the address. The handheld unit will not send a NACK, the host will time out instead.

- The host sends a header block indicating the amount of data it is going to send to handheld unit 17. (This block, and all subsequently sent by the host, has address number 17 embedded in it so other handheld units will ignore it.) This amount may be 0.
- The handheld unit acknowledges the header block with an ACK if it can receive this data, or a NO block if it cannot, or a NACK if the block is corrupted. (NACK makes the host send it again. NO makes the host skip the HOST TO HANDHELD stage.)
- The host sends each data block in turn and waits for the acknowledgement.
- Handheld unit 17 ACKs (data OK) or NACKs (data not OK) each block received, extracting and storing the data if valid. Each block includes a serial number, so that if the same block is received twice, the receiver can ignore it (but still send an ACK).
- Once the host has successfully sent all the blocks, the HANDHELD TO HOST stage can begin. The host waits for handheld unit 17 to send a data header.
- Handheld unit 17 sends a header block to the host indicating the amount of data it is going to send. This amount may be 0. This block can include the handheld unit address number as confirmation for the host, but does not need any other address information, as the other handheld units on the **3CCR** don't receive data sent by another handheld unit on the **3CCR**.
- The host acknowledges the header block with an ACK if it can receive this data, or a NO block if it cannot, or a NACK if the block is corrupted.
- Handheld unit 17 sends each data block in turn and waits for the acknowledgement, as described for host to handheld unit communications.
- When handheld unit 17 has received an ACK for its last data block, it sends an END block to the host, and releases the link (see below).

EXAMPLE PROTOCOL: detecting and handling errors:

- The transmitter adds error-checking data (such as a cyclic redundancy checksum, CRC) to each block.
- The receiver calculates its own CRC from the received data. If this matches the received CRC, it uses the data and returns an ACK. If it does not, it ignores the data and returns a NACK.
- If the transmitter receives an ACK, it proceeds with the next data block.
- If the transmitter receives a NACK, a corrupt acknowledge, or no acknowledge within a timeout period (eg 5 seconds), it sends the same block again, incrementing a counter. If this counter reaches a fixed limit (eg 5), it sends a CANCEL block and releases the link.
- If the receiver receives a CANCEL block, it releases the link.
- If the receiver does not receive the next block within a timeout period (eg 5 seconds), it sends a NACK block and increments a counter. If this counter reaches a fixed limit (eg 5), it releases the link.
- A handheld unit should immediately release the link if it receives a POLL block with another handheld unit's number in it.
- Both receiver and transmitter should also monitor the appropriate handshaking lines to ensure data validity, as is usual with communications applications. In particular it is essential for the handheld unit to monitor DSR, since the presence of this signal indicates a "good" Rack connection.
- The host and handheld unit may optionally log errors, sound alarms, display warnings, and attempt to re-establish a link which has failed.

EXAMPLE PROTOCOL: releasing the link:

- To release the link, a handheld unit turns DTR off. If it has successfully completed all its communications, it should also disable Rack communications and turn off, as described in section 4.4.10. If communications has been interrupted, it can re-start the link as described in section 4.4.4.
- To release the link to the current handheld unit, the host sends a POLL block for the next handheld unit.

- To release the link to the entire **3CCR** (eg if all handheld units in its list have been communicated with, or if the link is very noisy), the host turns DTR off (if this signal is connected from the host), or allows the link to time out.

4.4.8 Low level error handling

The following error conditions should be monitored continuously and appropriate actions taken:

- Loss of DSR: the connection to the **3CCR** has been lost. For example, the **handheld unit** may have been removed from the **3CCR**, or the contacts may have been disturbed. Ask the operator to indicate which, by sounding an alarm and displaying a prompt such as:

DISCONNECTED FROM 3CCR!
PRESS:
Y if removed from 3CCR
N to retry after remounting

- If the operator presses Y, disconnect as described in section 4.4.10.
- If the operator presses N, switch off DTR from the handheld unit, wait 2 seconds, then enable it again (INT 14H function 2CH), then re-establish contact as described in section 4.4.3.
- Timeouts: are handled as described in section 4.4.7. Timeouts indicating loss of the host connection can be handled as described below.

LOST HOST CONNECTION!
CHECK CONNECTION THEN PRESS
C to continue communications
F to finish communications

4.4.9 Using peripherals while on the 3CCR

When you enable Rack communications, access to the **Handheld's** ports is affected as follows:

- Port 1 (COM1) is disabled, so you cannot access it. (COM1 access is redirected to the **3CCR**.)
- Ports 2 and 3 are still available.

If these limitations are not acceptable, the application can disable Rack communications temporarily when required, using INT 14H, function 2FH.

While the handhelds are on the **3CCR** and actually **charging**, the current available to peripherals via the handheld unit's ports is restricted. It is therefore important that any peripherals attached to the Handheld are either powered down or disconnected. If it is essential to power peripherals whilst on the **3CCR**, then we recommend that the Handheld application disables charging whilst the peripheral is active and then re-enables charging as soon as peripheral activity is complete. In APM mode use INT 15H, function 7FH; in SPM mode, use INT 15H, function 8AH. (See the handheld's System Developer's Guide for more details.) The time required for a full charge will of course be lengthened accordingly.

Alternatively, if the peripherals are only powered while being accessed, the application can instead simply disable access to them while on the **3CCR**.

Caution: If you ignore these precautions and a handheld unit's peripheral draws more power than available while on the **3CCR**, it may fail to operate correctly, disrupting communications and charging for all Handheld units on the **3CCR** at that time.

4.4.10 Removal from the 3CCR

An operator can remove a handheld unit from the **3CCR** at any time by simply lifting it up. To avoid operators removing a handheld unit before it has finished charging and communications, the application should display status messages indicating the progress and completion of charging and communications (eg as a "percentage complete" bar), or a warning message such as **COMMUNICATIONS IN PROGRESS - DO NOT REMOVE**, and you should instruct the operators to check the display before removing the handheld unit.

NOTE: when a handheld unit is removed from the **3CCR** it may cause line noise. The application's communications protocol must make sure that this

does not interfere with communications by other handheld units at that time, by detecting and recovering from any such errors automatically.

The best technique, then, is to enable Advanced Power Monitoring (so the application can check the battery level). The application should check the power level (eg in a loop); when it is 100% and communications has finished, it should:

- Sound a short bleep and/or display a message like this:

**Communications and charging complete at
03:35. Remove from 3CCR.**

- Turn off (INT 15H function 68H).

Alternatively, the application could display the percentage charge continuously, for example as a "thermometer" bar.

However, in a typical application (with charging and communications overnight) where there is plenty of time for charging and communications, simpler techniques may be adequate. For example, you could set up a timer event to turn on and do the above shortly before operators are due to remove the handheld units from the **3CCR**.

If the operator removes a handheld unit from the **3CCR** while it is turned on, the application can detect this by the loss of DSR, then sound an alarm, display a warning message, or simply turn off, as appropriate.

4.4.11 Using a local printer

A serial printer can be connected to the right-hand end of the **3CCR** instead of the host, by using a crossed cable (see Appendix A.6). To print on this printer, a much simpler **3CCR** application is required in the handheld, as a printer cannot implement polling or an error-detection communications protocol!

This arrangement is most suitable for installations consisting of a single **3CCR** unit. If it is used with multiple units, to avoid problems with two applications trying to print at the same time, they should either prompt the operator to indicate when it can start printing, or each handheld unit should have a different fixed time period in which it is allowed to print.

5. Compatibility

5.1 Differences between the 3CCR & the FS CCR

For those users already familiar with the **HUSKY FS CCR**, the **3CCR** operates in a very similar manner. The guidelines for applications and communications software as described in Chapter 4 are very much the same. However, you should be aware of the following differences.

- Ring Indicator (RI) and Data Carrier Detect (DCD) signals are not supported by the **3CCR**. In most installations, even those with a modem, this should not be a problem. However, some existing **FS** applications may need a small modification if they made use of these signals. Please contact your System Provider or Husky's support department if you have any queries.
- The **3CCR** has 9-way (rather than 25-way) D-types and requires appropriate cables (see Appendix A.6).
- The **3CCR** uses a different AC Adaptor to the **FS CCR**. Use only the designated **3CCR** AC Adaptor.
- The **3CCR** is designed for mounting on a horizontal surface. No wall mount option is available, but if necessary the installer could provide a suitably angled shelf to produce a "wall mount" facility.
- The **3CCR** has Class A EMC approvals, and is intended for office or business installations. The **3CCR** is not intended for a home installation, and does not have the relevant domestic Class B EMC approval. A single Rack, the **HUSKY FS CCR**, is more appropriate for a domestic installation.
- The **3CCR** does not have separate LEDs to indicate Transmit and Receive activity. Instead, the "Connected" indicators will flicker whenever data is being transmitted or received. Note that, depending

on the amount of data and the ambient light levels, the visibility of the flickering (or twinkling) may be limited.

5.2 3CCR and HUSKY MP2500

As standard, the **3CCR** is not designed for use with the **HUSKY MP2500** handheld. However, a version of the **MP2500** with Rack Interface, and a variant of the **3CCR** may be considered for special contracts. Please contact your System Provider or WPI Husky Technology Ltd.

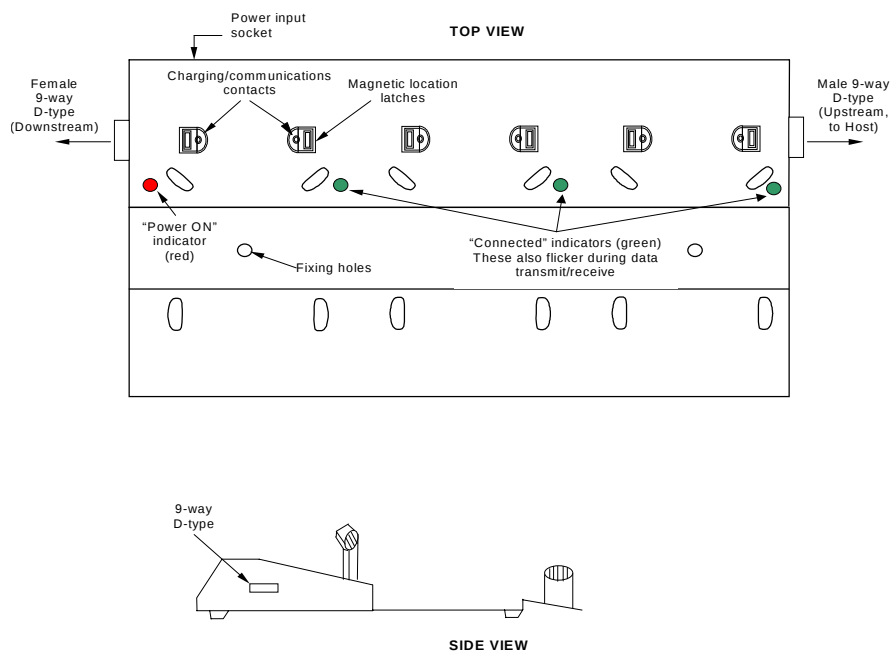
If the **3CCR** is to be used with **MP2500** handhelds, please note the following:

- **MP2500** handhelds are not designed to communicate above 19200 Baud (due to their slower 8MHz CPU speed).
- The **MP2500** only supports a 15 hour battery charge rate.
- A **3CCR** installation for **MP2500** units may use lower power AC Adaptors and will therefore not be suitable for **FS3** handhelds.
- The **MP2500** is slightly larger than the **FS** handheld family (due to its plastic rather than metal case). Hence, **MP2500** units will **not** fit on a standard **3CCR** (and **FS** handhelds may not be a secure fit on a **3CCR** variant meant for **MP2500**).

6. Appendices

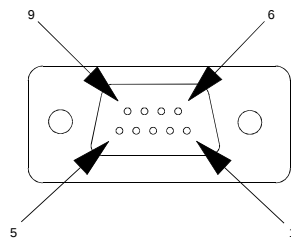
Appendix A: General arrangement & connections

The connector positions are shown below. The picture also shows the indicators and fixing holes. Note that the **3CCR** is not designed for mounting directly to a wall.



A.1 Upstream/host connector, 9-way D-type, male

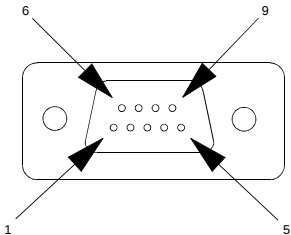
This connector is on the right-hand side of the **3CCR**. It connects to the host or modem, or to the next **3CCR** unit which is "upstream" (nearer the host) in the **3CCR** installation.



Pin	Description
1	NC
2	Received Data (from host)
3	Transmitted Data (towards host)
4	Data Terminal Ready (towards host)
5	Signal 0V
6	Data Set Ready (from host)
7	Request To Send (towards host)
8	Clear To Send (from host)
9	NC

A.2 Downstream connector, 9-way D-type, female

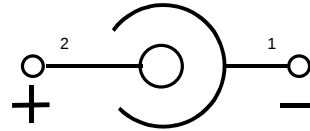
This connector is on the left-hand side of the **3CCR**. It connects to the next **3CCR** unit which is "downstream" from (away from) the host in the **3CCR** installation.



Pin	Description	
1	NC	
2	Received Data	(to next 3CCR)
3	Transmitted Data	(from next 3CCR)
4	Data Terminal Ready	(from next 3CCR)
5	Signal 0V	
6	Data Set Ready	(to next 3CCR)
7	Request To Send	(from next 3CCR)
8	Clear To Send	(to next 3CCR)
9	NC	

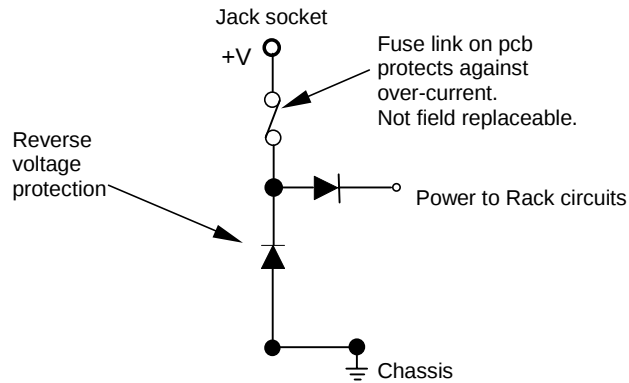
A.3 Power jack socket

The power jack at the top of each **3CCR** unit is the low voltage DC input, providing power to that **3CCR** unit only:



Pin	Description
1	Chassis Ground (0V)
2	DC power in (+V). See A.4.

A.4 Power input circuit



The diodes protect against reverse voltage.

Note that the pcb fuse link (which protects against over current being drawn by the **3CCR** electronics) is not field replaceable.

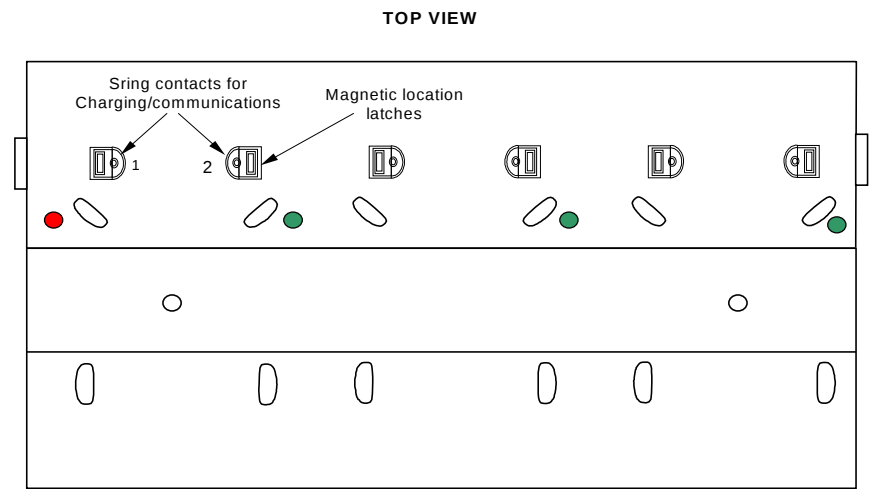
The input voltage requirements are:

DC power in	3.0A (nominal)
DC voltage	9.0V (nominal)
Absolute minimum voltage	8.0V
Maximum continuous voltage	10.0V

Note: The power supplied via the jack socket is **not** passed through to other **3CCR** units in the chain. Each **3CCR** requires its own AC Adaptor.

A.5 Spring contacts

The contacts on the front surface of the **3CCR** mate with matching contacts on the underside of the handheld unit:



Pin	Description
1	Chassis Ground (0V)
2	Charging voltage/communications (+V)

The contacts are protected against short circuits and over current.

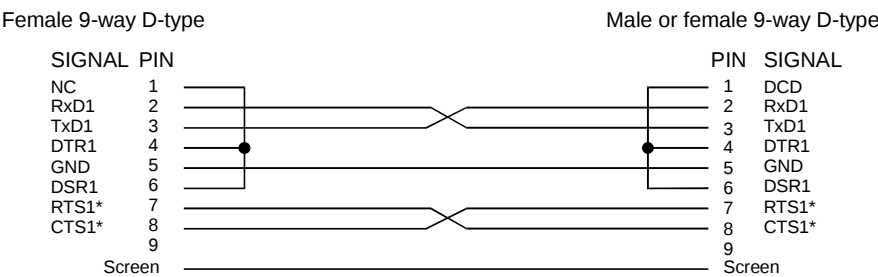
A.6 Example cables

The recommended maximum length for any cables used to connect to the **3CCR** is 5 metres (16 feet).

To connect to a host PC, you will need a null-modem or "crossed" cable. Depending on the type of serial connector on the host, you will need either a 25-way or 9-way connector at that end of the cable:

9-way "crossed" - available as **HUSKY** part number P-1940-0001 (2m long).

Cable with handshaking (5 wire comms)

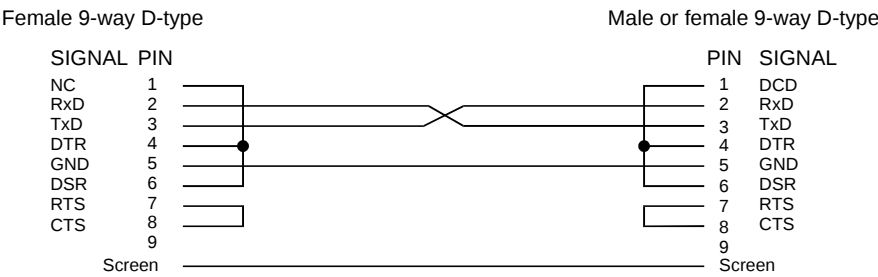


EMC Shielding: The screen is connected to each connector's cover and shell.

- * Do not connect the RTS and CTS handshake lines for communications speeds greater than 19,200 Baud - refer to section 2.6. A suitable cable is available as **HUSKY** part number P-1930-0001, which connects only Tx, Rx and GND (a "three wire crossed" cable).

9-way "3-wire crossed" cable - available as **HUSKY** part number P-1930-0003 (2m long).

Cable without handshaking (3 wire comms)

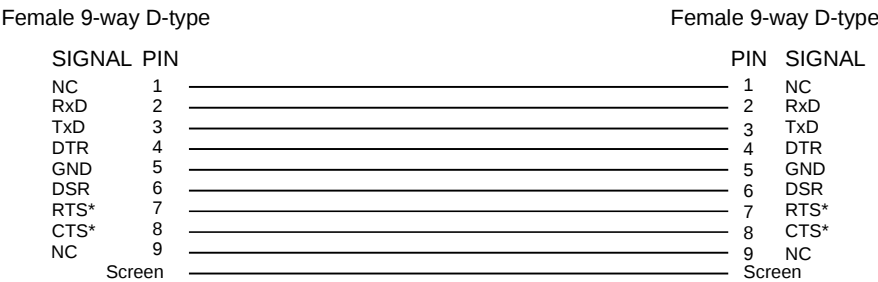


EMC Shielding: The screen is connected to each connector's cover and shell.

To connect to a modem or printer, or to daisy-chain **3CCR** installations, you will need a "straight" cable, with 9-way D type connectors:

9-way "straight through" cables – in these cables, all pins are connected. Two versions are available from **HUSKY**:

- i) A 1.5m cable P-1930-0001 for directly connecting **3CCR** units, where the units are arranged in rows, one row above the next. Also for direct connection to a modem.
- ii) A 50mm "short" cable P-1930-0002 for directly connecting adjacent **3CCR** units.



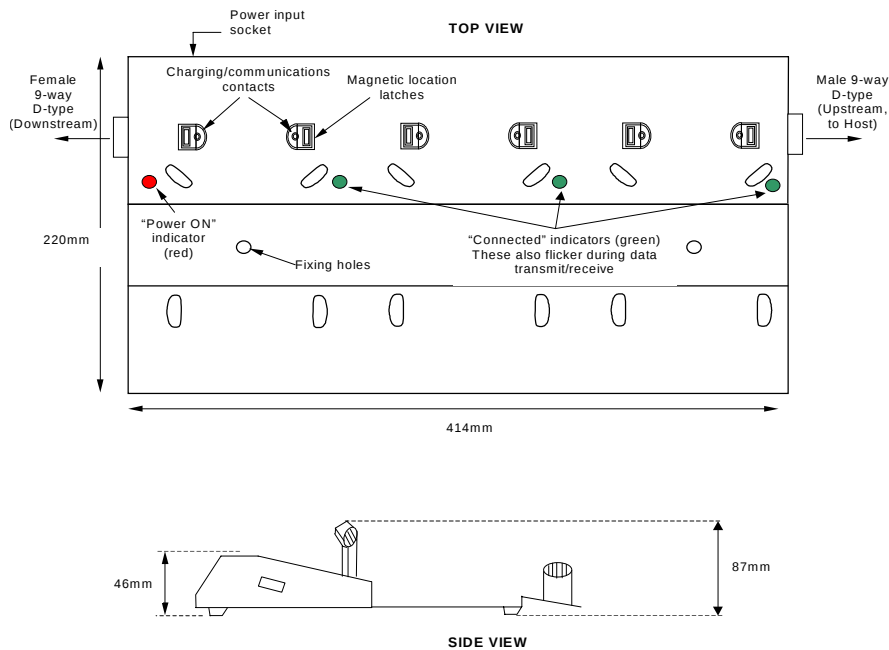
EMC Shielding: The screen is connected to each connector's cover and shell.

- * Do not connect the RTS and CTS handshake lines for communications speeds greater than 19,200 Baud - refer to section 2.6.

Appendix B: Specification

B.1 Physical

Construction	Extruded aluminium with durable abrasion-resistant grey paint finish. Aluminium baseplate and padded handheld unit supports.
Weight	1520 grams (54 oz).
Size, Bench mounted	226mm (8.9 ins) deep 428mm (16.6 ins) wide excluding connectors 46mm (1.8 ins) high excluding handheld supports 87mm (3.4 ins) high including handheld supports



B.2 Communications

Type	Full duplex between host and handheld units, by modulating the charging voltage. Host may be replaced by a modem or a local printer.
Baud rate	Up to 38,400 Baud (TxD and RxD ONLY). Up to 19,200 Baud (TxD, RxD, CTS and RTS).
Signals	RxD, TxD, RTS, CTS, DTR. DSR is emulated by the handheld unit.
Delays	A propagation delay not exceeding 5 microseconds through <i>each</i> hand-held position on each 3CCR unit (between host connector and downstream connector), which may limit the Baud rate in large installations.
Indicator LEDs	POWER – good power to the 3CCR CONNECTED – continuous = good contact with the handheld unit flickering = data being sent to or received by the handheld unit

B.3 Environment

Operating temperature	-10°C to +50°C (14°F to +122°F). Note: Handheld units will disable charging when operating below approx. 5°C (41°F) or above approx. +40°C (104°F).
Storage temperature	-30°C to +70°C (-22°F to +158°F).
Environment	Designed for indoor operation. Not recommended in areas with excessive dust build-up or corrosive atmospheres.
Moisture	Will operate continuously at 90% relative humidity, non-condensing.

Electromagnetic	Refer to the EMC statements near the end of this guide.
Electrostatic	Conforms to EN50082 and IEC 801-2. discharge
Chemical resistance	Designed to tolerate normal surface contaminants found in office and commercial environments.
UV	Withstands levels of UV normally found in an indoor environment.

B.4 Options

Power supplies	AC adaptors for powering the 3CCR from an AC supply.
Cables	To connect to: An external modem. A host PC. Other 3CCR units.
Software	HUSKY file transfer utility (HCOM).

AC Adaptor - Precautions

USE THE AC POWER ADAPTOR ONLY AFTER READING AND UNDERSTANDING THE FOLLOWING PRECAUTIONS.

HUSKY AC Adaptors are class II (double insulated with no earth) and built to EN60950: 1988 or EN60742: 1989, BS415 and DIR73/23/EEC safety requirements, and international EMC standards including EN55022 classes A and B.

HUSKY AC Adaptors supplied for use in North America meet UL safety requirements, FCC Part 15 EMC regulations (classes A and B), and CSA EMC regulations (classes A and B).

- Hazardous voltages inside, do not attempt to open.
- No user serviceable parts inside, do not attempt to open.
- Indoor use only.
- Avoid liquid spillage, do not connect if suspected damp.
- Ensure ventilation is not restricted.
- Use only the **3CCR AC Adaptor**. This special adaptor should never be replaced by an alternative unapproved model, as damage may result.
- Inspect adaptor before connecting, do not use if there are signs of damage or deterioration.
- Ensure rechargeable batteries are fitted and they are oriented correctly.
- Battery chemical leakage is corrosive, do not touch. (In case of accidental contact wash immediately with running water.)
- Ensure connectors are firmly mated.
- Avoid mechanical strain to cables or connectors.
- Switch on or connect mains (line) supply only after making all connections.
- Switch off or disconnect mains (line) supply before disconnecting.
- In the event of overloading due to a fault, the adaptor is designed to be fail safe and may stop functioning.
- Do not attempt to employ the **3CCR AC Adaptor** for alternative purposes.
- Use only a readily accessible power outlet, and disconnect when not in use.
- Although the **3CCR AC Adaptor** is rated for continuous operation, it is important not to exceed the charging limitations of the battery. Refer to appropriate instructions on charging regime.
- Avoid use in dusty or contaminated environments.

Electromagnetic Compatibility (EMC)

! CAUTION

Approved accessories only may be used with this equipment. In general all cables must be high quality, shielded, correctly terminated and normally restricted to 2 metres length. **3CCR** AC Adaptors employ special provisions to avoid radio interference and should not be altered or substituted.

Unapproved modifications or operation beyond or in conflict with these instructions for use may void authorisation to operate the equipment.

Europe

This apparatus complies with the radio interference protection requirements of the Council Directive 89/336/EC on the approximation of the laws of the Member States of the European Union relating to electromagnetic compatibility. The product was tested in a typical configuration and found to conform to the following test specifications:

EN55022 Radiated and conducted emissions – Class A

EN50082 ESD and radiated and conducted immunity.

Warning: Class A products, intended for use only in commercial and industrial environments, may cause interference in a domestic environment, in which case the user may be required to take appropriate countermeasures. Products which only conform to residential, commercial and light industrial immunity testing, may suffer from malfunction in a heavy industrial environment.

For further compliance details, refer to the specific CE Declaration Of Conformity. This is available on request, quote the exact and full order code for the product(s) in question.

USA

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations (ICES-003).

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada (NMB-003).

Index

- 3CCR
 - introducing, 1
 - cables, 49
 - checking operation, 12
 - dimensions, 52
 - electrical nature of signals, 26
 - extending, 14
 - female D-type, 45
 - installing, 8
 - interconnecting, 9
 - LEDs, 13, 53
 - male D-type, 44
 - operating, 17
 - operating environment, 53
 - options, 54
 - power jack, 46
 - power supplies, 8
 - programming, 25
 - siting, 9
 - specification, 52
 - spring contacts, 48
- 3CCR options, 54
 - cables, 8
 - power supplies, 8
 - software, 20
- AC adaptors, 8, 10
 - precautions, 55
- Cables
 - crossed with handshaking, 49
 - crossed without handshaking, 50
 - daisychain, 50
 - host cable, 49, 50
 - modem cable, 50
 - null modem, 49, 50
 - printer cable, 49
 - straight, 50
- Charging, 19
 - controlling, 29
 - monitoring, 29
- Checking operation, 12
- Conventions, 3
- EMC legislation, 56
- Fault-finding, 12, 22
- File transfer utility (HCOM), 20
- HCOM utility, 20
- Indicator LEDs, 13
- Installing
 - introduction, 8
 - additional modules, 14
 - cables, 8
 - checking operation, 12
 - choosing a site, 9
 - EMC regulations, 56
 - host connection, 11
 - interconnections, 10
 - local printer, 11
 - modem, 11
 - options, 8
 - power supplies, 8, 10, 55
- Introduction to
 - 3CCR, 1
 - installing, 8
 - operating, 17
 - other guides, 5
 - programming, 25
 - this guide, 2
- LEDs, 13, 53
 - connected, 13, 18, 19
 - power, 13, 18, 22
- Maintenance, 21
- Operating
 - introduction, 17
 - charging, 19
 - communications, 19
 - connecting a handheld unit, 18
 - disconnecting, 21
 - file transfer utility (HCOM), 20
 - HCOM utility, 20
 - problems, 22
 - routine maintenance, 21
 - shutting down, 21
 - troubleshooting, 22

- turning on, 18
- Pinouts
 - female D-type, 45
 - male D-type, 44
 - power jack, 46
 - spring contacts, 48
- Power input circuit, 47
- Power jack pinouts, 46
- Power supplies, 8, 10
- Precautions
 - AC adaptors, 55
 - EMC, 56
- Problems, 12, 22
- Programming
 - introduction, 25
 - checking DSR, 31
 - checking the connection, 31
 - communications speeds, 28
 - controlling charging, 29
 - data blocking, 32
 - detecting the 3CCR, 30
 - error handling, 28
 - handshaking signals supported, 26
 - monitoring charging, 29, 38
 - monitoring communications, 38
 - polling, 32
 - principles, 29
 - receiving data, 31
 - removal from 3CCR, 38
 - seizing the link, 32
 - selecting Rack communications, 31
 - sending data, 32
 - using a local printer, 39
 - using DTR, 31, 32
- Protocol
 - introduction, 32
 - ACK, 34, 36
 - addresses, 32
 - broadcast messages, 33
 - collision avoidance, 32
 - CRC, 36
 - dropping DTR, 36
 - error handling, 33, 36, 37
 - loss of DSR, 37
 - NACK, 35, 36
 - polling handheld units, 34
 - releasing the link, 36
 - seizing the link, 34
 - summary, 33
 - using DTR, 34
- Routine maintenance, 21
- Signals
 - CTS, 27
 - DCD, 29
 - DSR, 27, 31
 - DTR, 27, 31
 - electrical nature, 26
 - RI, 29
 - RTS, 27
 - RxD, 27
 - speed limitations, 28
 - TxD, 27
- Specification, 52
- Status indicators, 13
- Trouble-shooting, 12, 22
- Typefaces, 3